

YSU GRIMs淺積雲參數法之評估

蔡雅婷 洪景山 曾千祐
中央氣象局氣象資訊中心

103 / 09 / 17

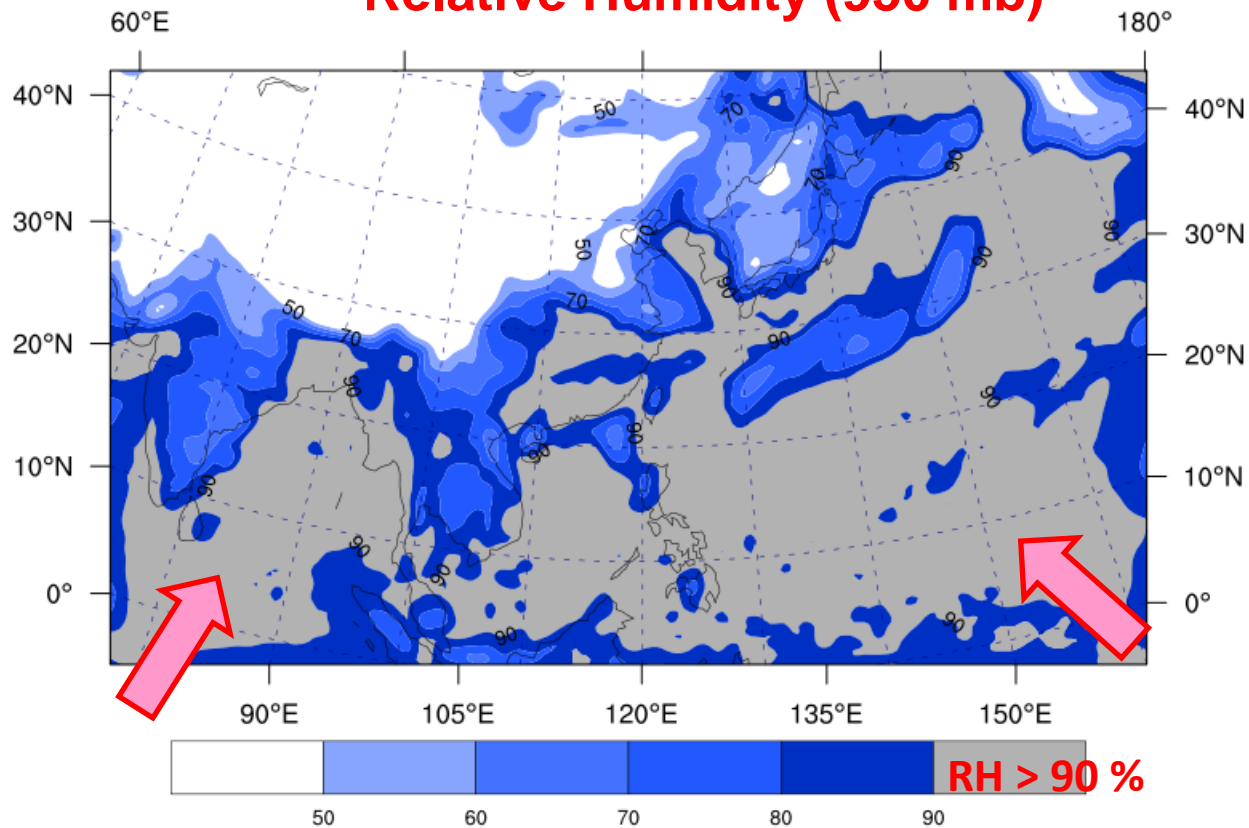
OUTLINE

- Motivation
- Introduction to the Shallow Convection
- Result

Motivation

2008060800 Tau=0024

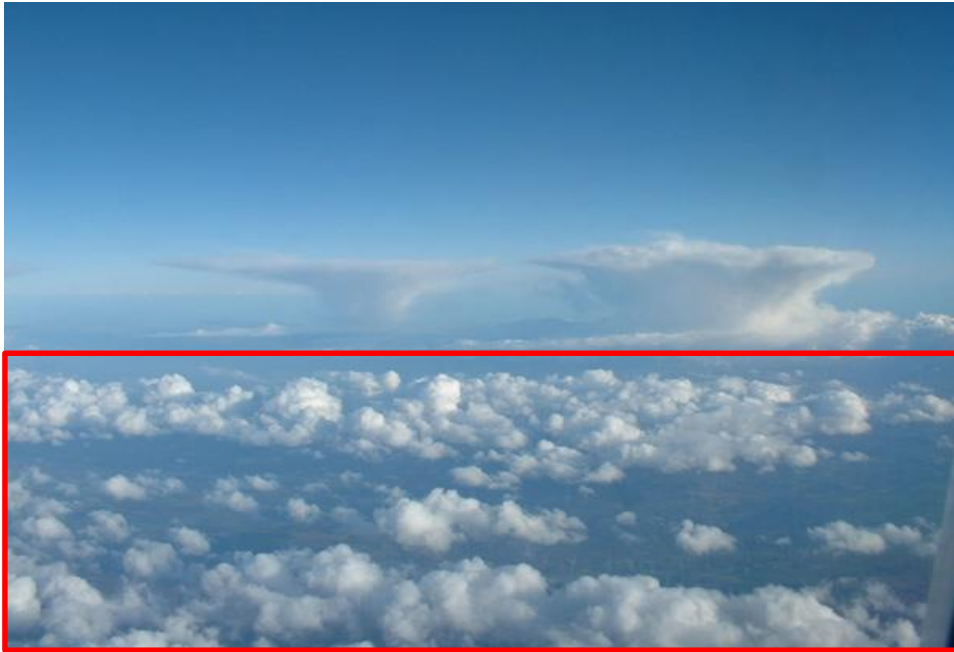
Relative Humidity (950 mb)



Too much moisture over ocean

評估淺積雲參數化方法

- 是否能改善海洋邊界層的發展
 - 是否能降低低層雲過多的現象
-
-



subsiding from
free-troposphere



cool/moisten

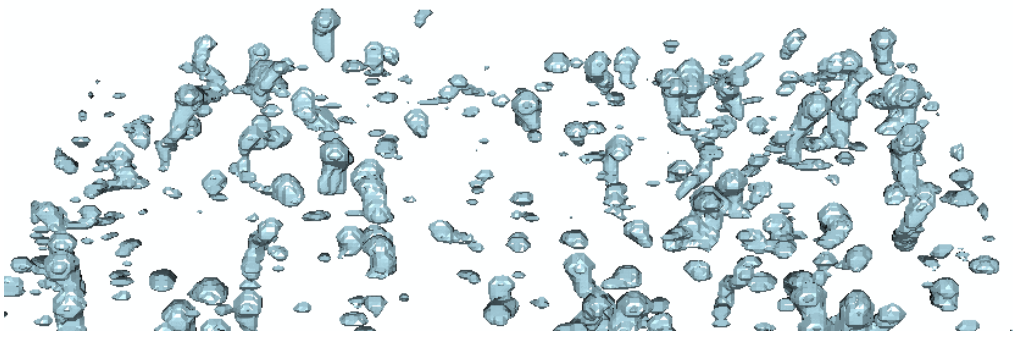
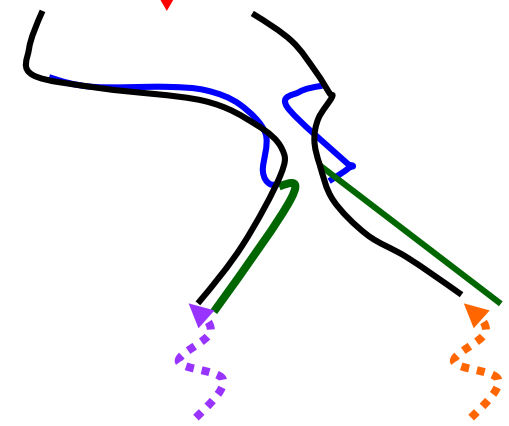
warm/dry



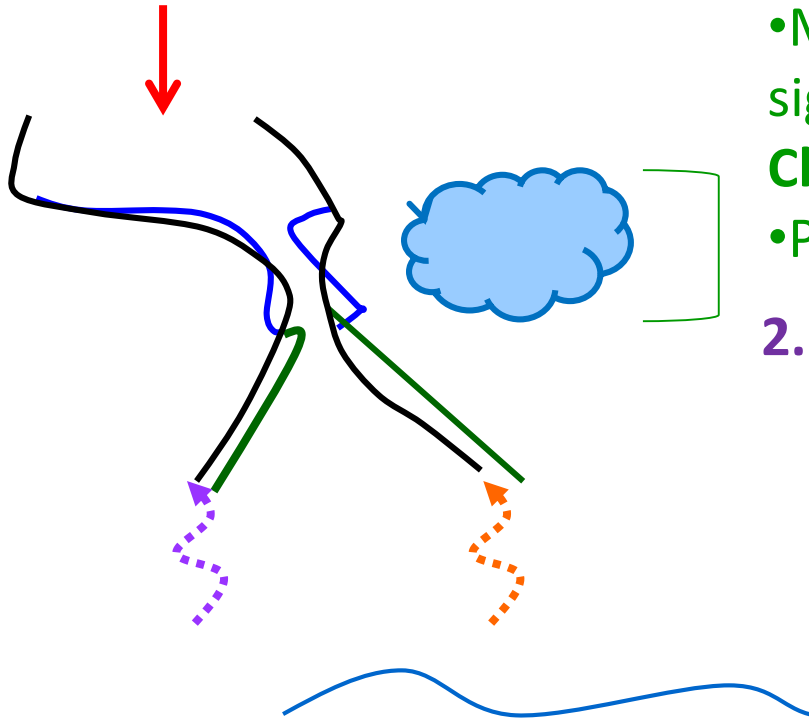
LCL



Sensible and **Latent** heat fluxes



YSU GRIMs淺積雲參數法



1.

Cloud top:

- Minimum moist static energy (below sigma .lt. 0.6)

Cloud bottom:

- PBL (check the parcel buoyancy)

2. Eddy diffusivity approach

$$\frac{\partial \bar{T}}{\partial t} = \frac{1}{\rho} \frac{\partial}{\partial z} \left[\bar{\rho} K \left(\frac{\partial \bar{T}}{\partial z} + \Gamma \right) \right]$$

$$\frac{\partial \bar{q}}{\partial t} = \frac{1}{\rho} \frac{\partial}{\partial z} \left[\bar{\rho} K \frac{\partial \bar{q}}{\partial z} \right]$$

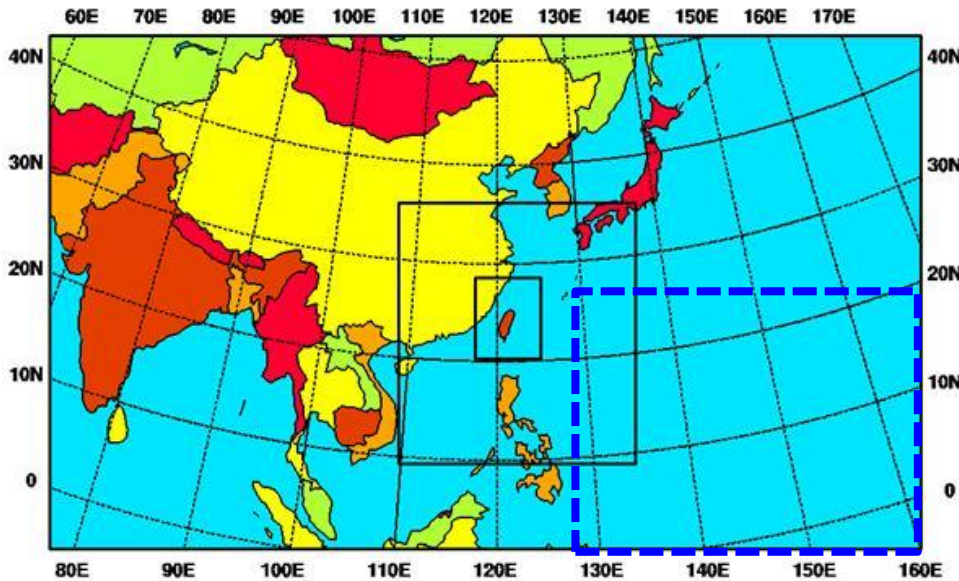
$$K = RH \times 1.47 w \times \delta \times \left(1 - \left(\frac{z}{h} \right)^3 \right)$$

Experiment and Conclusion :

- Model setting
 - **CTL VS. SHCU** (YSU Grims shallow scheme)
 - Date: 2008060800 @ fcst =24
-
-
-

Model setting

Domain of CWB WRF



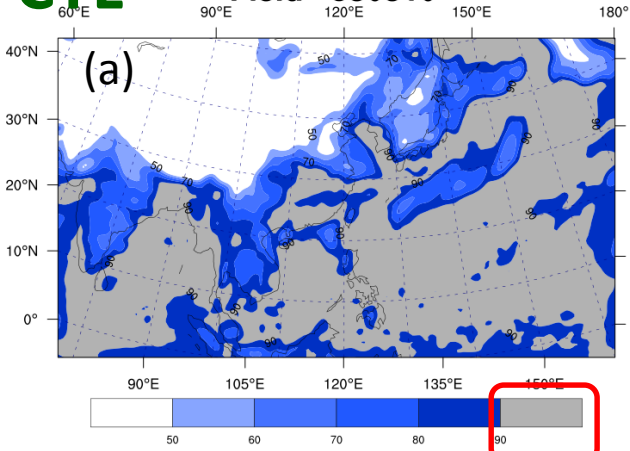
mp_physics	Goddard 5-class scheme
bl_pbl_physics	Yonsei University scheme
ra_lw_physics	RRTM scheme
ra_sw_physics	Goddard shortwave
sf_sfclay_physics	Monin-Obukhov scheme
sf_surface_physics	NOAH

模式邊界條件	模式解析度	X方向格點數	Y方向格點數	垂直層數
NCEP GFS預報場	45 KM	222	128	45層

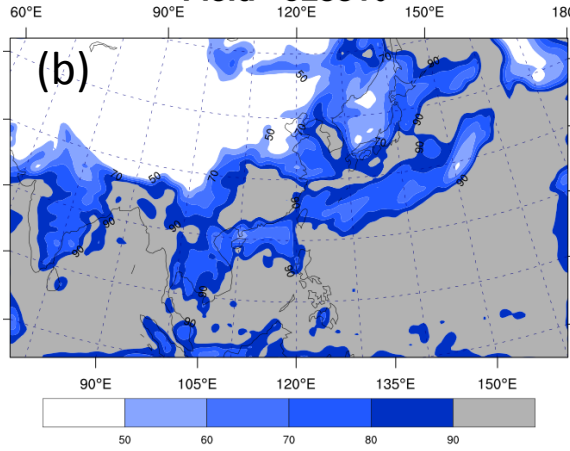
Low Level Relative Humidity

CTL

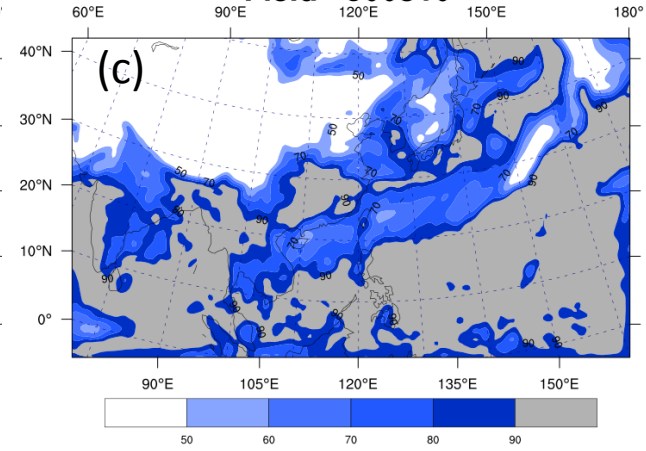
2008060800 Tau=0024
Field= 950510



2008060800 Tau=0024
Field= 925510



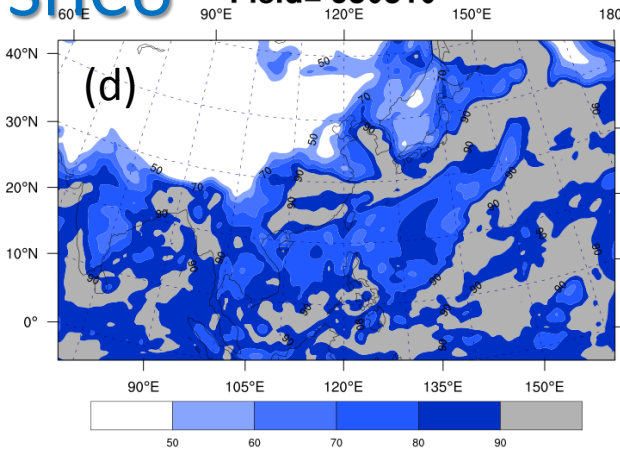
2008060800 Tau=0024
Field= 900510



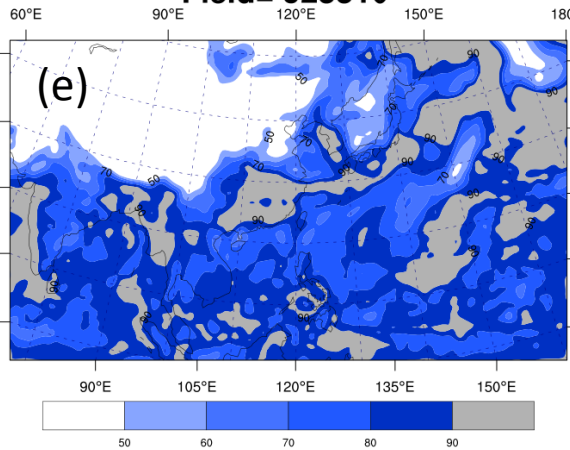
RH > 90 %

SHCU

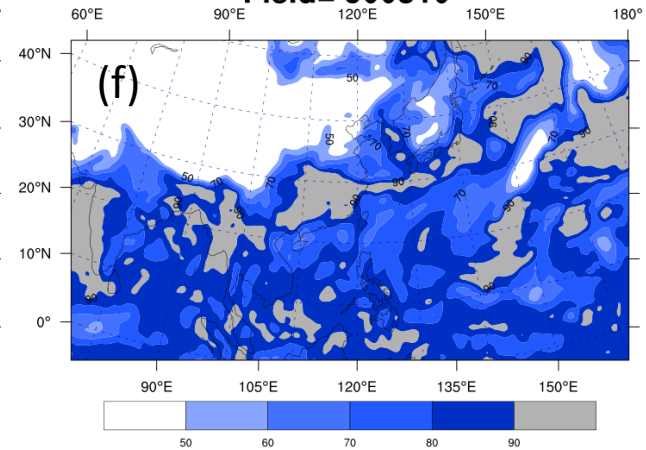
2008060800 Tau=0024
Field= 950510



2008060800 Tau=0024
Field= 925510



2008060800 Tau=0024
Field= 900510



Influence on Low-Level Cloud

eta levels= 0.97 ~ 0.89

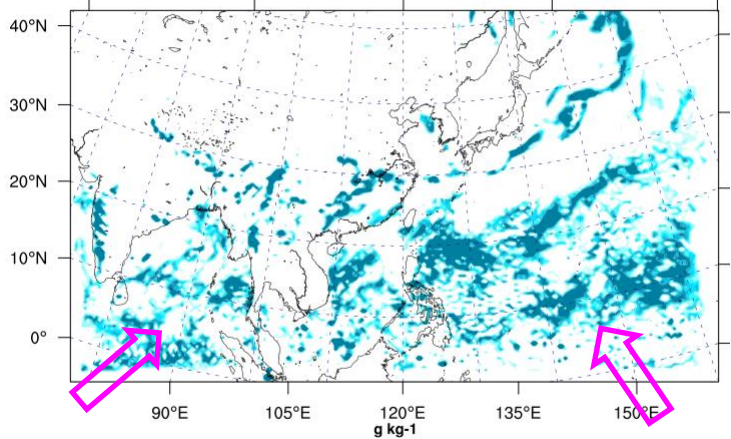
at hour 24



CTL

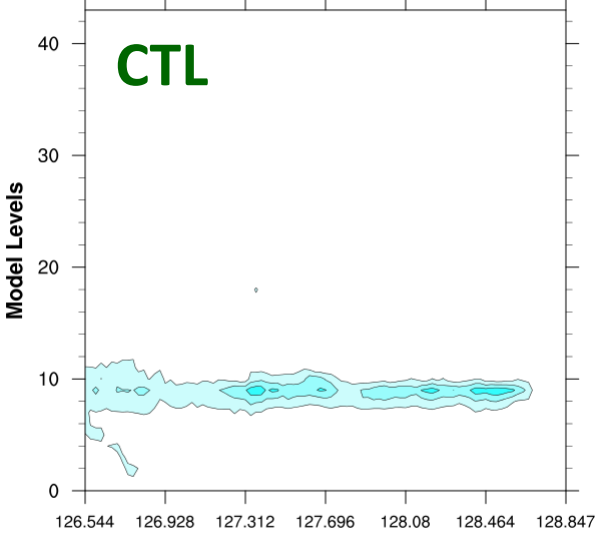
QCLOUD + QRAIN at 7-10 levels

2008060800 - 2008060800 MEAN/ 24-hr forecast WRF_OP26_mean
60°E 90°E 120°E 150°E 180°



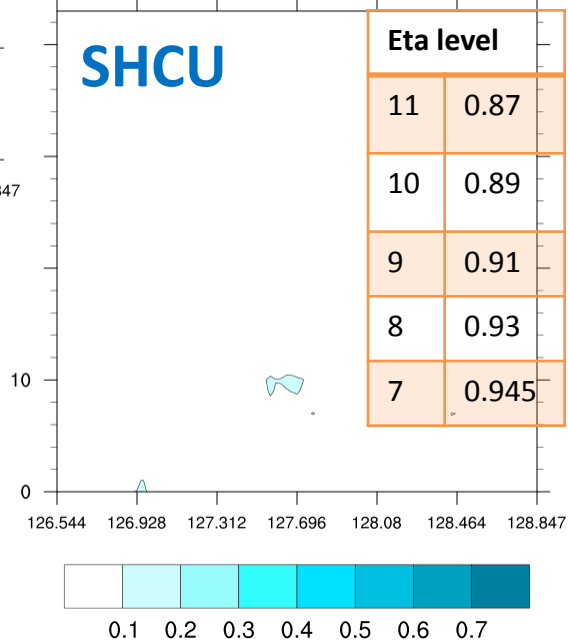
MEAN QCLOUD+QRAIN over Ocean

2008060800 / 24-hr forecast OP26 g kg-1

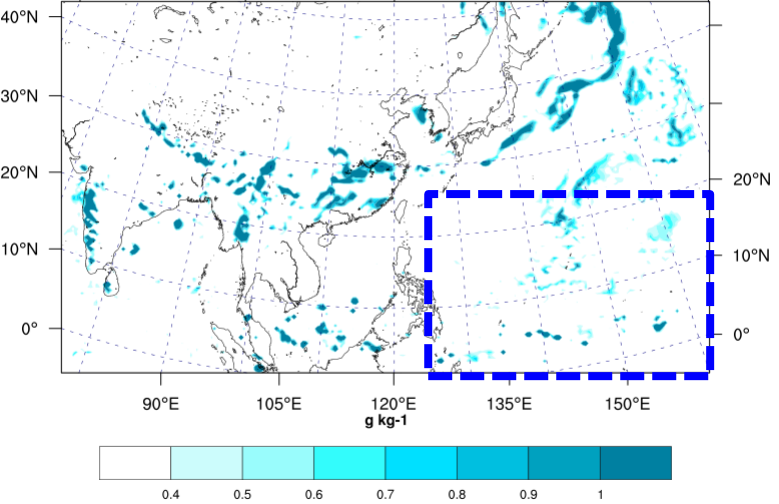


MEAN QCLOUD+QRAIN over Ocean

2008060800 / 24-hr forecast SHCU g kg-1



SHCU



Change in Shortwave Radiation / Temperature at 2M / Latent Heat Flux difference at hour 24

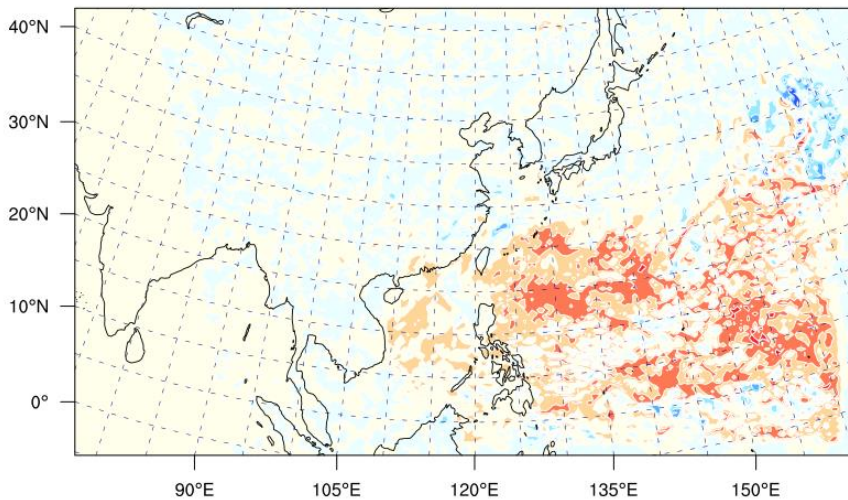
SHCU – CTL

SWDOWN

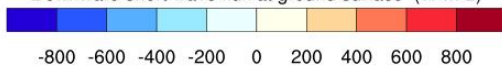
WRF SHCU-OP26

Init: 2008-06-08 00:00:00
Valid: 2008-06-09 00:00:00

Downward short wave flux at ground surface (W m-2)



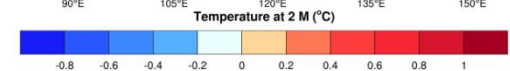
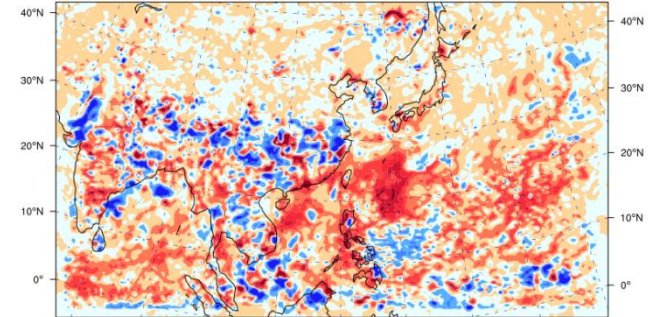
Downward short wave flux at ground surface (W m-2)



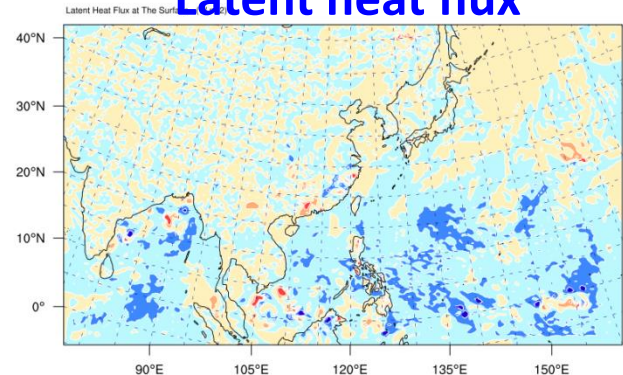
T2

T2 difference at hour 24

2008060800 - 2008060800 / 24-hr forecast SHCU-OP26



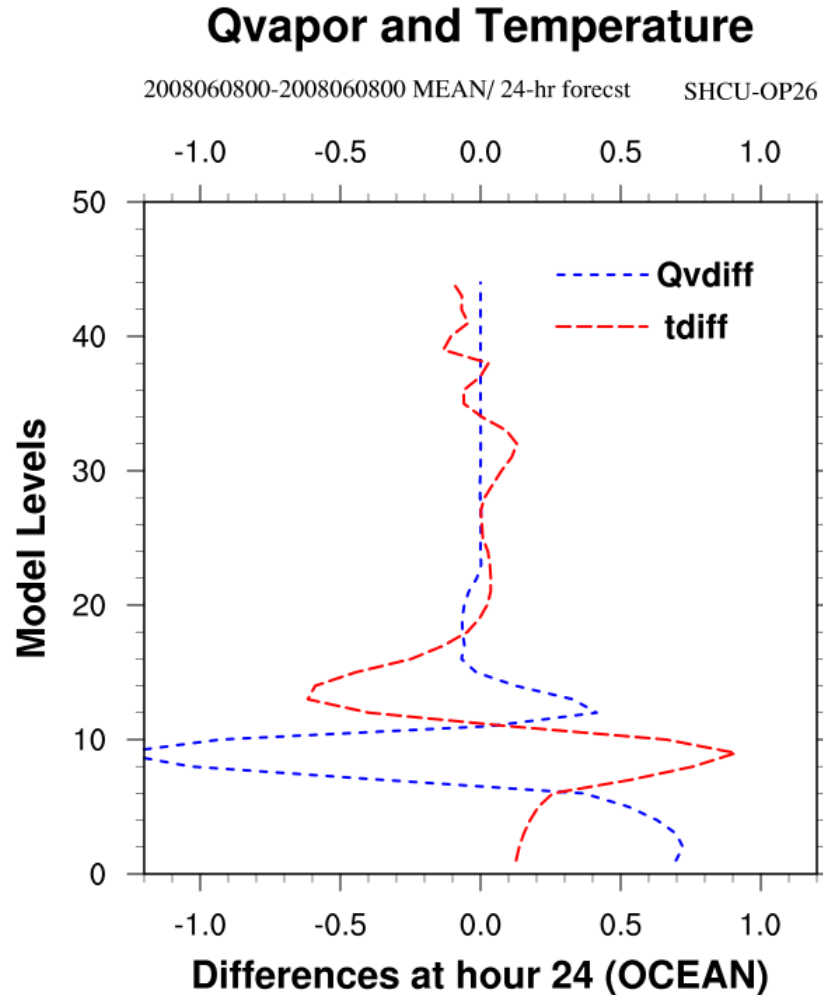
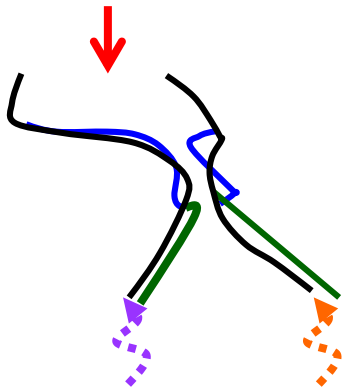
Latent heat flux



Latent Heat Flux at The Surface (W m-2)



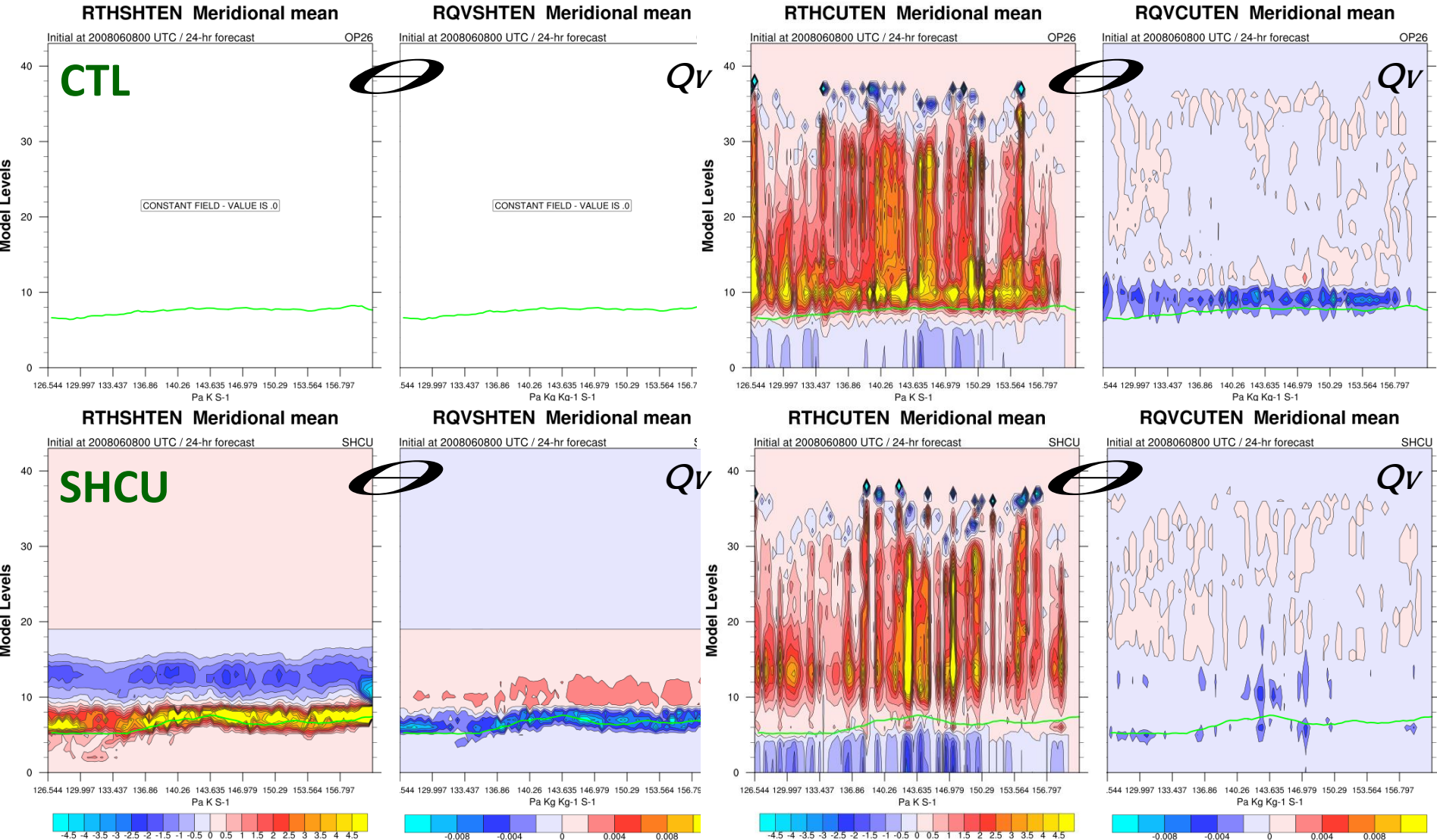
Temperature and Qv Change difference at hour 24



Budget analysis from the model physical process

Shallow Cumulus

Cumulus scheme



Budget analysis from the model physical process

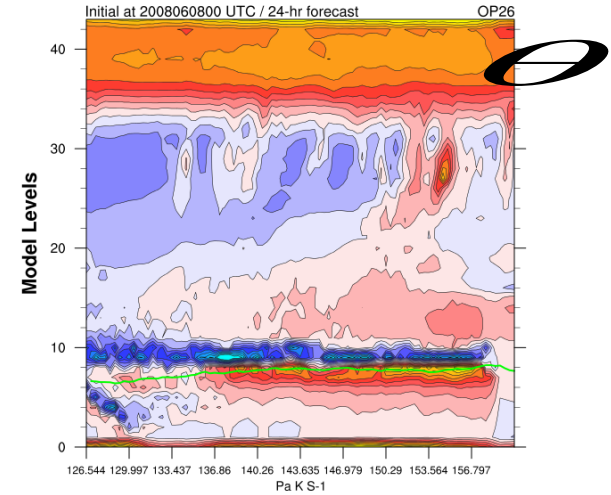
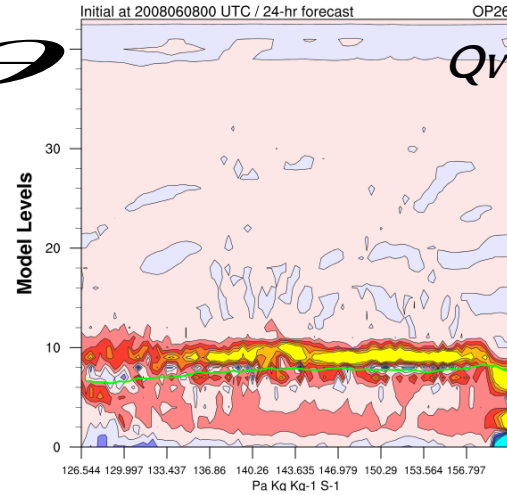
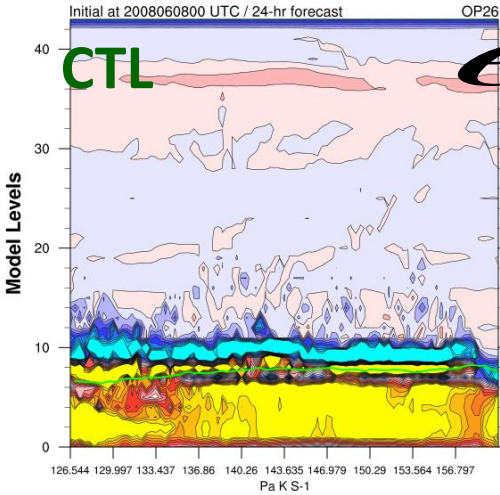
PBL Parameterization

Radiation Parameterization

RTHBLTEN Meridional mean

RQVBLTEN Meridional mean

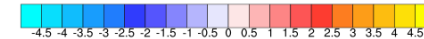
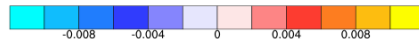
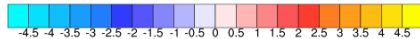
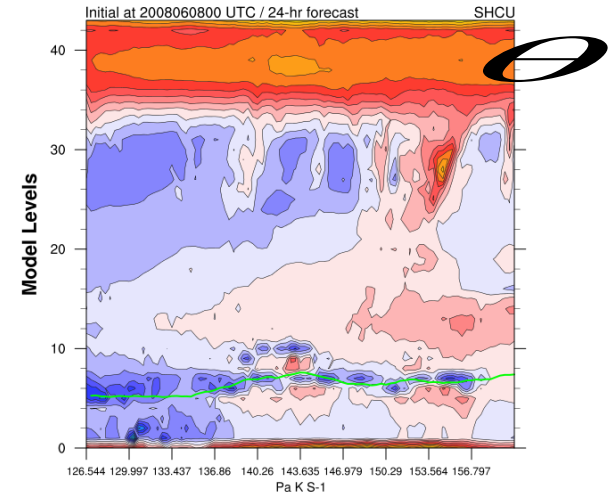
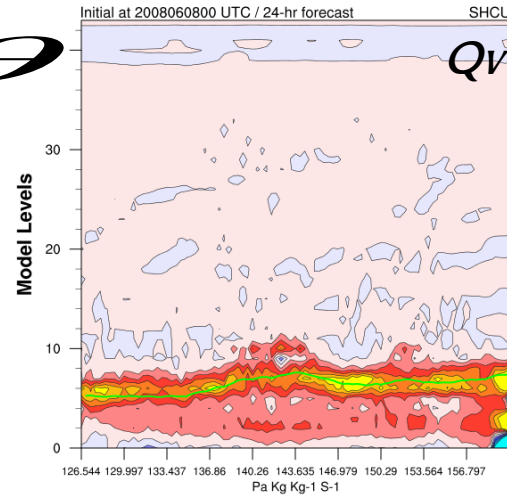
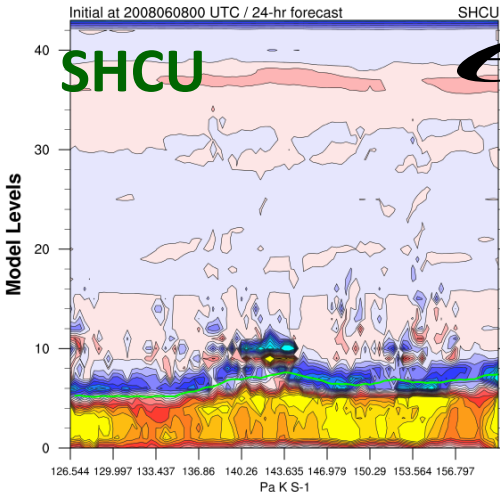
RTHRATEN Meridional mean



RTHBLTEN Meridional mean

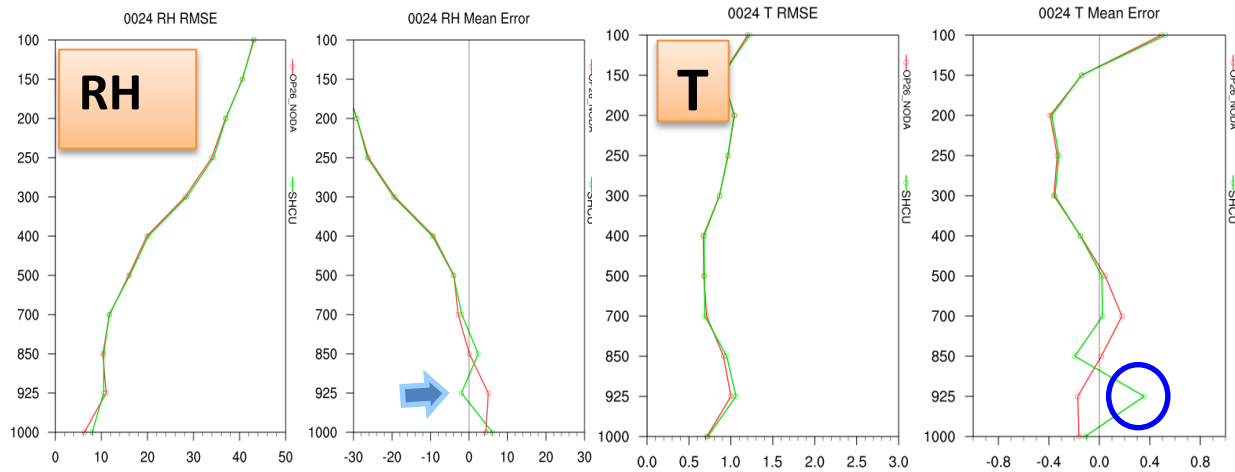
RQVBLTEN Meridional mean

RTHRATEN Meridional mean



Conclusion

- YSU Grims 淺積雲參數化方法可以有效改善海洋邊界層層狀薄雲覆蓋現象



- 15日模式預報校驗結果發現邊界層溫度偏差變大
=> 調整淺積雲參數法中eddy diffusivity coefficient (K)



END

